Relationships Between Obesity and *DSM-IV* Major Depressive Disorder, Suicide Ideation, and Suicide Attempts: Results From a General Population Study

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ABSTRACT

Objectives. This study sought to test the relationships between relative body weight and clinical depression, suicide ideation, and suicide attempts in an adult US general population sample.

Methods. Respondents were 40 086 African American and White participants interviewed in a national survey. Outcome measures were past-year major depression, suicide ideation, and suicide attempts diagnosed according to the *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition*. The primary predictor was relative body weight, treated both continuously (i.e., body mass index [BMI]) and categorically in logistic regression analyses. Covariates included age, income and education, disease status, and drug and alcohol use.

Results. Relative body weight was associated with major depression, suicide attempts, and suicide ideation, although relationships were different for men and women. Among women, increased BMI was associated with both major depression and suicide ideation. Among men, lower BMI was associated with major depression, suicide attempts, and suicide ideation. There were no racial differences.

Conclusions. Differences in BMI, or weight status, were associated with the probability of past-year major depression, suicide attempts, and suicide ideation. Longitudinal studies are needed to differentiate the causal pathways and mechanisms linking physical and psychiatric conditions. (*Am J Public Health*. 2000;90:251–257)

Obesity is an increasingly prevalent public health problem, with approximately half the current US population overweight or obese.[1] Although many studies have shown that obesity is associated with numerous medical complications and increased all-cause mortality,[2,3] much less is known about its association with clinical depression and suicidal tendencies. Clinical observations since the turn of the century have postulated a possible association between obesity and depression.[4] These observations have received some support from epidemiologic studies suggesting a relationship between being overweight and having increased psychiatric symptoms.[5,6] However, other community studies have failed to find direct associations between obesity and depression.[7–9] These discrepancies may relate in part to sex differences, as some data suggest associations between obesity and subclinical depression in females but not males.[6]

In 1995, a major review paper showed that the empirical findings on this issue have remained inconsistent.[10] This review identified several methodologic problems in the previous studies. First, none of the studies assessed the presence or absence of clinical depression diagnosed according to a standardized nomenclature such as the *Diagnostic and Statistical Manual of Mental Disorders* (currently in its fourth edition [*DSM-IV*][11]). Instead, continuous-scale scores of "psychopathology" were used. These scales differ among themselves in content. Moreover, they have also been shown to have only a modest relationship, at best, with the specific syndrome of depressed mood, symptoms, and impairment lasting at least 2 weeks, which is defined in *DSM-IV* as major depressive disorder.[12]

Second, with rare exceptions (e.g., the study by Istvan et al.[6]), nationally representative samples were not used. Much of the data came from clinical studies,[10] many of which did not include a control group of obese individuals *not* seeking treatment. Lack of such a control group may have introduced several treatment selection biases.[13] Among the community studies to address this topic, many sampled from a local geographic region, and none used DSM criteria for diagnosis.

Third, few studies have explicitly examined whether the association between obesity and psychopathology varies by race. This is important because it has been hypothesized that race may moderate the relationship between obesity and psychiatric status.[10] Consistent with this hypothesis, African American women appear, on average, to be more satisfied with their bodies, to have less desire to be thin, and to have less fear of fat than do White women.[14] However, other data suggest that the association between obesity and self-esteem is the same between these races.[15] The inconsistent findings may be due in part to the use of nonpsychiatric outcomes and the inconsistent control of socioeconomic status (SES) across these studies. Investigating racial differences while controlling for SES is particularly important because SES has been associated with both obesity and race.[16] Differences in outcome may also relate in part to the dieting status of subjects; certain studies have examined only dieters.[15] It is also noteworthy that these studies examined indicators or "symptoms" of psycho-

pathology rather than formal psychopathology. As a result of these issues, certain basic questions concerning the co-occurrence of obesity and psychiatric disorders remain unresolved.[10]

Several factors point to the public health significance of obesity and its potential association with psychopathology. The first factor is the current prevalence of obesity in the general population, estimated at 19.9% and 24.9% in men and women, respectively.[1] Certain calculations suggest that, given trends over the past 30 years, the entire US population could be obese by the year 2230 if these trends persist.[17] The second factor is that numerous health disorders are associated with obesity, including diabetes mellitus, hypertension, dyslipidemia, and perhaps certain types of cancer.[3] The third factor is that epidemiologic data suggest an association between physical and psychiatric disorders.[18] This association has been postulated to increase the likelihood of health service utilization and the length of stay in treatment programs.[19] Moreover, mood disorders have been associated with poor treatment outcome and diminished compliance for other health-related conditions.[20,21] Thus, the relationship of depression to obesity may be a relevant consideration in public health and clinical efforts to design weight-reduction programs.

In light of the shortcomings of previous studies, we investigated the following research questions: (1) Is relative body weight positively associated with clinical depression, suicide ideation, and suicide attempts? (2) Is relative body weight's association with major depression, suicide ideation, and suicide attempts different for men and women? (3) Is relative body weight's association with major depression, suicide ideation, and suicide attempts different for Whites and African Americans? On the basis of past research using subclinical measures of depression, we hypothesized that (1) there would be a positive relationship between relative body weight and *DSM-IV* major depression, suicide ideation, and suicide attempts among women, and (2) this association would be stronger among White than African American women. Specific predictions were not made for African American men, given the lack of previous empirical or theoretical work to guide hypotheses.

This study was designed to overcome the 3 methodological problems identified above. We investigated these hypotheses in a nationally representative sample, assessed depression according to *DSM-IV* criteria, and used a sample with a sufficient representation of White and African American respondents to test for group differences while controlling for SES.

Methods

Sample

This study was based on the 1992 National Longitudinal Alcohol Epidemiologic Survey (NLAES), which involved face-to-face interviews of 42 862 household residents 18 years or older in the contiguous United States, including the District of Columbia. All interviews were conducted by the Bureau of the Census. Data from the NLAES are weighted to produce national estimates with adjustments for nonresponding. Details of the multistage sampling procedure have been described elsewhere[22] (also B. F. Grant, unpublished data, 1994). The household response rate was 91.9% and the sample person response rate was 97.4%.[22,23] NLAES respondents who identified themselves as African American or White were the focus of the present study. After 2033 respondents of other racial backgrounds were excluded, the sample included 40 829 respondents. Of these, 743 (1.8%) were excluded because of missing height or weight data. This resulted in a final sample size of 40 086. No significant differences were noted between the sample used for the present analyses (n = 40 086) and the complete sample (n = 40 829) on demographic (excluding race) or psychopathology measures.

Measures

Alcohol Use Disorders and Associated Disabilities Interview Schedule (AUDADIS). The AUDADIS is a fully structured interview designed to be administered by trained lay interviewers.[24] The AUDADIS elicits detailed information on alcohol, drug, and depressive disorders according to *DSM-IV* criteria, as well as on medical conditions, legal and illicit substance use, sociodemographic characteristics, and other content areas. All data were derived from the participant's responses during the interview; these data included self-reported weight and height.

Major depression, suicide ideation, and suicide attempts. The AUDADIS includes an extensive list of questions that operationalize *DSM-IV* criteria for major depression. The questions concerning symptoms in the 12 months before the interview were the focus of this study. Consistent with *DSM-IV*, the AUDADIS diagnosis of major depression requires the presence of a chronic and persistent depressed mood for at least 2 weeks. Thus, intermittent depressed mood was excluded. A minimum of 5 out of 9 possible depression symptoms were required to have occurred during the period of disturbance, and 1 of these must have been depressed mood or anhedonia. Social and/or occupa-

tional dysfunction must have also occurred. Periods of depression during bereavement or physical illness were ruled out, in accordance with *DSM-IV* criteria. The test–retest reliability (κ) of the AUDADIS diagnosis of major depression was 0.66 for household residents.[23,25] Suicide ideation and suicide attempts in the prior 12 months were based on the responses (i.e., yes or no) to questions assessing these behaviors in the AUDADIS major depression section.

Relative body weight. Relative body weight was operationally defined both as categorical and as continuous variables to make our findings comparable with those of previous studies that used both approaches.[26] Body mass index (BMI; weight in kilograms divided by height in meters squared) was calculated from participants' self-reported height and weight. For categorical analyses, we grouped participants into 3 "weight status" categories based on standard BMI cutoffs[27]; these categories were "underweight," "average weight," and "obese." Underweight was defined as a BMI of 20.77 or less, representing the lower 15% of the BMI distribution in the sample. Obesity was defined as a BMI of 30 or more, representing approximately the upper 15% of the BMI distribution. Average weight was defined as a BMI between 20.78 and 29.99. (According to new guidelines from the National Heart, Lung. and Blood Institute,[1] individuals with a BMI between 25.01 and 29.99 are overweight. Thus, 45% [n = 12 737] of the participants in the average-weight group in this study would be categorized as overweight.)

For multivariate logistic regression analyses, weight status was investigated as 2 contrasts in which the average-weight group served as the comparison group (i.e., underweight vs average weight; obese vs average weight). To place these cutoffs in perspective, the average BMI in the United States is approximately 26, with a standard deviation of about 5. For a person whose height is 5 ft 5 in, a BMI of 25 corresponds to a weight of approximately 68 kg (or about 150 lb). For a person whose height is 5 ft 10 in, a BMI of 25 corresponds to a weight of approximately 79 kg (or about 174 lb).

Analyses were also conducted that treated BMI as a continuous variable. These analyses investigated associations over the entire range of relative body weight in the general population. Changes in log odds for models are presented in terms of 10-unit increments of BMI, since this magnitude corresponds roughly to 2 standard deviations of BMI in the general population. Self-reported BMI has been shown to be quite reliable and valid.[28] Specifically, BMI has a test–retest reliability of 0.99[29] and a coefficient of variation of 1% or less.[28] When correlated against

a laboratory-based research method for estimating fat mass, validity coefficients for BMI were reported to be 0.54[30] and 0.93.[31]

Covariates. Background and demographic information derived from the AUDADIS included sex (0 = female, 1 = male), race (0 = White, 1 = African American), age, education, past-year household income, and disease status. Educational status included 2 indicator variables that represented a high school degree only and at least some college education. Past-year income represented the participant's self-reported total household income for the 12 months before the interview. The simultaneous adjustment for income and education served as a control for the possible confounding effect of SES. To address the fact that lifetime disease status may be related to current body weight and depression, we included disease status in the analyses (0 = no, 1 = yes). A positive score indicated the lifetime occurrence of at least 1 of 8 ailments that have been related to obesity (i.e., stroke, diabetes, heart attack, cancer, arthritis, arteriosclerosis, stomach ulcer, and high blood pressure). Substance use may have confounded the relationship between relative body weight and depression and suicidal tendencies. Thus, in post hoc analyses, we controlled for illicit drug use, alcohol use, and cigarette use (0 = no, 1 = yes) in the previous 12 months. Table 1 presents demographic information on the entire sample. Table 2 presents descriptive information for weight status by sex.

Data Analysis

SUDAAN[32] was used for all statistical analyses. Statistical procedures that assume simple random sampling would yield incorrect standard errors and test statistics, given the complex survey design of the NLAES. SUDAAN accounts for the complex sampling method and provides appropriate standard errors and statistical tests.[32] The Satterwaite adjusted χ^2 test statistic was used for assessing the statistical significance of all model estimates,[32] and all associations between variables are presented as odds ratios.

Bivariate logistic regression models were used to test our first research question; that is, they were used to investigate the unadjusted relationships between outcome variables (i.e., major depression, suicide ideation, and suicide attempts) and relative body weight (i.e., weight status and BMI), respectively. For analyses of the continuous BMI variable, linear (BMI) and nonlinear (BMI^2) terms were entered into the regression models to account for possible curvilinear relationships with the respective outcome variable. This was done because nonlinear associations between BMI and mortality have been demonstrated in the literature.[33]

Multivariate logistic regression analyses were used to test our second and third research questions: whether sex and race moderate the relationship between relative body weight and each of the respective outcome measures. These analyses also adjusted for the potential confounding effects of age, education, past-year income, and reported disease status. A separate regression analysis was conducted for each outcome variable (i.e., major depression, suicide ideation, and suicide attempts). Analyses were also conducted for each definition of relative body weight (i.e., categorical weight status and continuous BMI). Post hoc analyses were conducted to investigate the effects of past-year illicit drug use, alcohol use, and cigarette smoking on the observed relationships. Each drug use variable was tested in a separate logistic regression model for its unique influence (in conjunction with the covariates from the main analyses).

Results

Bivariate Relationships

Both BMI ($\chi^2_1 = 14.8$, $P < .001$) and BMI^2 ($\chi^2_1 = 9.63$, $P = .001$) were significantly associated with *DSM-IV* major depression. These results indicated a U-shaped relationship, with relatively high and low BMI values associated with an increased probability of major depression. Neither BMI^2 nor its interactions with other terms were significant in the multivariate logistic regression models, so BMI^2 was dropped from further models. Neither BMI nor BMI^2 was associated with suicide ideation (BMI $\chi^2_1 = 2.92$, $P = .09$; BMI^2 $\chi^2_1 = 2.42$, $P = .12$) or suicide attempts (BMI $\chi^2_1 = 2.46$, $P = .11$; BMI^2 $\chi^2_1 = 3.11$, $P = .08$).

The unadjusted analyses using the categorical indicator of weight status showed that, compared with average-weight respondents, underweight respondents had increased odds of past-year *DSM-IV* major depression (odds ratio [OR] = 1.37; 95% confidence interval [95% CI] = 1.18, 1.61) and suicide ideation (OR = 1.51; 95% CI = 1.28, 1.78). The obese group had increased odds of suicide ideation (OR = 1.21; 95% CI = 1.02, 1.44) relative to average-weight respondents. No obese vs average-weight group differences were demonstrated for depression or suicide attempts.

Multivariate Logistic Regression Analyses

In the first set of analyses, we tested whether the adjusted relationship between weight status and the outcome variable differed between men and women and whether

any observed sex difference was equivalent for Whites and African Americans. Specifically, the logistic regression model for each outcome variable included a 3-way interaction term (i.e., sex by weight status by race) to test this question. Results of analyses indicated no significant interaction of sex by weight status by race for major depression ($\chi^2_{2.75} = .64$, $P = .86$), suicide ideation ($\chi^2_{2.80} = 1.76$, $P = .57$), or suicide attempts ($\chi^2_1 = .001$, $P = .98$). These results indicate that any sex difference was equivalent for Whites and African Americans. Similar findings were demonstrated when the 3 logistic regression analyses were rerun with BMI as opposed to weight status representing relative body weight.

In a second set of analyses, we investigated whether the relationship between weight status and the outcome variable differed between sexes (i.e., men vs women) and between racial groups (i.e., Whites vs African Americans). To test these questions, we included in the logistic regression model for each outcome variable appropriate 2-way interaction terms: sex by weight status and race by weight status. These analyses did not include the 3-way interaction term (i.e., sex by weight status by race) demonstrated to be nonsignificant in the previous analyses. Results indicated no significant race–by–weight status interaction for major depression ($\chi^2_{1.99} = 4.96$, $P = .09$), suicide ideation ($\chi^2_{1.96} = .57$, $P = .77$), or suicide attempts ($\chi^2_1 = .59$, $P = .44$). Thus, the associations between weight status and the 3 psychiatric outcomes were not different for African Americans and Whites. By contrast, the sex–by–categorical weight status interaction was significant for all 3 outcomes: major depression ($\chi^2_{1.96} = 17.93$, $P = .0001$), suicide ideation ($\chi^2_{1.97} = 10.26$, $P = .007$), and suicide attempts ($\chi^2_{1.97} = 6.08$, $P = .04$). Thus, the associations between weight status and the 3 psychiatric outcomes were different for men and women. Table 3 shows the odds ratios for the association of weight status and psychiatric outcome for males and females. Relative to average-weight women, obese women had increased odds of past-year major depression (OR = 1.37; 95% CI = 1.09, 1.73). However, relative to average-weight men, obese men had decreased odds of a major depressive disorder (OR = 0.63; 95% CI = 0.60, 0.67) and decreased odds of suicide attempts (OR = 0.63; 95% CI = 0.48, 0.83). Furthermore, relative to average-weight men, underweight men had increased odds of suicide ideation (OR = 1.81; 95% CI = 1.71, 1.89) and suicide attempts (OR = 1.77; 95% CI = 1.34, 2.33) in the past year. For women, no significant differences were demonstrated between the underweight and average-weight groups in all 3 psychiatric outcomes.

Similar findings were demonstrated when the analyses were rerun with BMI as opposed to weight status, with one notable exception. Among women, increasing BMI was associated with increased odds of suicide ideation (OR = 1.22; 95% CI = 1.13, 1.32). Table 3 shows the odds ratios for the association of weight status and psychiatric outcome for males and females.

Additional analyses that used the National Heart, Lung, and Blood Institute 4-category weight classification yielded substantially similar results. Relative to average-weight men (BMI = 18.5–24.9), overweight men (BMI = 25.01–29.99) were significantly less likely to have had past-year major depression (OR = 0.68; 95% CI = 0.52, 0.87), suicide ideation (OR = 0.67; 95% CI = 0.53, 0.85), or suicide attempts (OR = 0.46; 95% CI = 0.22, 0.95). No differences between average-weight and overweight women were demonstrated. The overall pattern of odds ratios remained consistent with those obtained from the main analyses that treated BMI as a continuous variable.

Controls for Drug and Alcohol Use

We conducted additional analyses to investigate the possible confounding effects of past-year illicit drug use, alcohol use, and cigarette use. These variables may have been especially relevant for men, among whom an association between reduced relative body weight and increased psychopathology might be predicted. The inclusion of cigarette use or alcohol use did not significantly change the magnitude of the observed relationships for either men or women for the categorical weight status variable (an increase in the multicollinearity among the predictor variables increased the standard errors of the estimates, which resulted in wider confidence intervals). In the analyses treating BMI as a continuous variable, past-year illicit drug use somewhat reduced the relationships with psychiatric outcome but did not cause the relationships to become statistically nonsignificant.

Discussion

An extensive literature has documented the medical complications of obesity.[2,3] However, few population-based studies have tested the association between obesity and psychopathology,[10] and, to our knowledge, none have incorporated DSM diagnostic criteria. This dearth of data is cause for concern, given the public health significance of obesity and its potential relation to depression. Overweight and obesity, taken together, are

TABLE 1—Demographic Characteristics: National Longitudinal Alcohol Epidemiological Survey, 1992

	Unweighted n	Weighted % (SE)[a]
Sex		
Male	16 764	48.20 (0.31)
Female	23 322	51.80 (0.31)
Race		
African American	5 981	12.12 (0.39)
White	34 105	87.88 (0.39)
Education		
Below high school	8 179	18.97 (0.31)
High school diploma	12 902	32.78 (0.32)
Some college	19 005	48.25 (0.43)
Weight status		
Underweight (BMI ≤20.77)	5 831	13.77 (0.21)
Average weight (BMI 20.77–29.99)	28 215	71.55 (0.26)
Obese (BMI >29.99)	6 040	14.67 (0.22)
Psychopathology		
Suicide attempts	244	0.60 (0.05)
Suicide ideation	1 454	3.43 (0.12)
DSM-IV major depression	1 400	3.37 (0.11)
Continuous variables[b]		
Age		44.04 (0.16)
BMI		25.44 (0.03)

Note. BMI = body mass index; *DSM-IV* = *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition.*
[a]Weighted prevalence estimates for the White and African American general household population for the 12 months before the interview.
[b]Means and standard errors are presented.

very prevalent in the general population. Given past epidemiologic trends, these prevalence rates are expected to continue to rise. Moreover, these findings might be relevant to obesity treatment, since for other health conditions, mood disorders are associated with poor treatment outcome and diminished compliance.[20,21]

This study differed from previous studies in several ways. First, the US general household population was sampled. Second, *DSM-IV* diagnostic criteria were applied on the basis of data from a structured psychiatric interview. Third, we tested the potential moderating effects of race and sex.[10] Fourth, we analyzed relative body weight as a continuous variable (BMI) and did not rely on a single, idiosyncratic cutoff for defining obesity.[8,34,35] Finally, to our knowledge, this is the first nationally representative study to examine obesity in relation to suicide attempts and ideation.

Results of this study indicated that there was a significant unadjusted association of body weight with *DSM-IV* major depression. These results indicated a U-shaped relationship such that relatively high and low BMI values were associated with an increased probability of past-year major depression. However, a curvilinear relationship was not demonstrated for depression when relative body weight was investigated as a categorical variable based on frequently used cutoff points for obesity. Instead, a linear relationship was found, with underweight respondents, relative to average-weight respondents, having decreased odds of major depression and suicide ideation. The obese group did not differ from the average-weight group on depression or suicide attempts; however, a group difference was demonstrated for suicide ideation. These results highlight the variation in outcome that can result when different operational definitions of relative weight are used.

Results of the present study also indicated that the relationship between relative body weight and clinical depression and suicidal tendencies was different for men and women. Obesity was associated with an *increased* risk of depression among females but a *decreased* risk of depression among males. Among women, obesity was associated with a 37% increase in the probability of being diagnosed with major depression, while for men, obesity was associated with a decrease of similar magnitude. The positive association between relative body weight and the probability of *DSM-IV* major depression among adult women is consistent with findings from previous studies using subclinical indexes of psychological well-being.[6,36] Similar findings emerged for suicide ideation and attempts when BMI was analyzed as a continuous variable. Among females, a 10-unit increase in BMI increased the risk of past-

TABLE 2—Descriptive Statistics by Weight Class Within Sex

	Underweight (SE)	Average Weight (SE)	Overweight (SE)
Men			
	n = 1191	n = 13143	n = 2430
Age, y	38.6 (0.20)	43.03 (0.21)	44.9 (0.36)
Household income, $1000	34.3 (1.5)	44.6 (6.6)	42.0 (1.1)
BMI	19.5 (0.04)	25.2 (0.02)	33.3 (0.08)
Race, %			
White	88.2 (1.62)	89.2 (0.44)	86.4 (0.90)
African American	11.8 (1.62)	10.8 (0.44)	13.6 (0.90)
Education, %			
<11th grade	24.5 (1.36)	17.3 (0.44)	20.9 (1.00)
High school	31.6 (1.51)	30.5 (0.54)	34.8 (1.12)
Attended college	43.9 (1.63)	52.3 (0.64)	44.4 (1.15)
Marital status, %			
Married	48.1 (1.8)	67.7 (0.58)	74.0 (0.91)
Divorced/widowed	10.6 (0.94)	10.7 (0.27)	10.7 (0.27)
Never married	41.3 (1.7)	21.6 (0.56)	15.3 (0.77)
Past-year depression, %	4.4 (0.68)	2.9 (0.17)	1.2 (0.17)
Past-year suicide ideation, %	6.4 (0.85)	3.0 (0.18)	3.2 (0.39)
Past-year suicide attempt, %	1.2 (0.34)	0.5 (0.07)	.3 (0.11)
Women			
	n = 4640	n = 15072	n = 3610
Age, y	40.4 (0.36)	45.9 (0.23)	47.3 (0.35)
Household income, $1000	41.5 (1.1)	38.0 (5.6)	29.3 (8.1)
BMI	19.3 (0.02)	24.5 (0.02)	34.5 (0.09)
Race, %			
White	92.3 (0.48)	87.6 (0.45)	78.1 (0.99)
African American	7.7 (0.48)	12.4 (0.45)	21.9 (0.99)
Education, %			
<11th grade	15.2 (0.61)	18.9 (0.42)	28.7 (0.99)
High school	29.8 (0.82)	35.2 (0.48)	36.3 (0.97)
Attended college	55.0 (0.82)	45.9 (0.56)	35.0 (0.99)
Marital status, %			
Married	55.4 (0.88)	62.3 (0.41)	57.6 (0.70)
Divorced/widowed	21.4 (0.61)	23.2 (0.39)	27.3 (0.88)
Never married	23.1 (0.84)	14.6 (0.41)	15.2 (1.04)
Past-year depression, %	4.4 (0.33)	3.6 (0.17)	4.7 (0.40)
Past-year suicide ideation, %	4.1 (0.32)	3.3 (0.18)	4.3 (0.38)
Past-year suicide attempt, %	0.6 (0.12)	0.7 (0.08)	1.0 (0.19)

Note. BMI = body mass index.

year suicide ideation and attempts by 22%; among men, however, a 10-unit increase in BMI reduced the risk of past-year suicide ideation and attempts by 26% and 55%, respectively. These findings emerged after adjustment for covariates. The mechanisms underlying this association cannot be determined here and may relate to the stigma of obesity for women in Western culture,[37–39] the greater tendency of obese women than of nonobese women to eat in response to negative emotions,[40] or both. A critical role for future studies will be to disentangle these and other possible pathways.

The intriguing finding among men was the association between being underweight and having an increased probability of clinical depression and suicidal tendencies. The relationship between lower BMI and depression was demonstrated previously in a community sample of young male adults.[10] When we analyzed weight status as a categorical variable in this study, underweight men were 81% more likely to have thought about suicide, 77% more likely to have attempted suicide, and 25% more likely to be clinically depressed than average-weight men. This again underscores the importance of understanding the psychological correlates of underweight among males. A possible interpretation of this finding concerns the psychosocial consequences of being underweight among men. Some data suggest that men judge a smaller body frame to be less preferable than a larger, more muscular one.[41] In addition, lower body weight appears to be associated with a poorer body image than does heavier body weight among men.[42] To the extent that men consider progressively lower relative body weights to be undesirable, a view that may be reinforced by societal standards, this might partially explain our findings for males. This hypothesis awaits empirical validation.

The associations between relative body weight and clinical depression and suicidal tendencies were comparable for Whites and African Americans even after SES was controlled for. These results are consistent with findings from a recent study that demonstrated similar associations between dissatisfaction with one's body and self-esteem among Whites and African Americans,[15] and they support the conclusion that "obesity-related attitudes in African American communities cannot be interpreted simplistically as a uniformly positive view of obesity."[43(p80)]

The strength of the associations demonstrated in this study, while modest, is consistent with that demonstrated in previous investigations. Nonetheless, these estimates may underrepresent the true all-cause association between relative body weight and depression. We conducted a very stringent analysis, ruling out a diagnosis of depression if it co-occurred with periods of illness or bereavement. Although this reduced any confounding effects of physical illness, it may have eliminated an important mediator between BMI and depression (i.e., physical disorders). Consequently, the "true" all-cause relationship between BMI and *DSM-IV* major depression may have been underestimated. This conjecture is supported by studies demonstrating an association between physical and psychiatric disorders.[18,44] Furthermore, when we conducted additional analyses (not shown) invoking a diagnosis of major depression that did not rule out illness, the strength of the association between BMI and past-year major depression increased (i.e., for women; OR = 1.51; 95% CI = 1.29, 1.76).

The present results should be interpreted in light of other population studies that have failed to detect an association between obesity and psychological well-being.[45] As discussed previously, failure to detect such an association may have been due in part to methodological and measurement issues.[10,46] Associations between body weight and depression may also depend on age, with certain findings not emerging until adulthood. For example, Wadden and colleagues[47] failed to detect an association between weight and depression in a sample of children.

The present findings should be interpreted in light of the present study's limitations. First, the cross-sectional design did not allow us to test for causal inferences regarding the development of depression and obesity or their relation over time. Direction of effect cannot be inferred in the present study.

Second, all information was derived from a face-to-face structured interview. Although test–retest reliabilities in this sample were adequate, reporting biases cannot be ruled out. For example, although the US Bureau of the Census employs a highly trained and professional staff who are sensitive to cultural differences, a

TABLE 3—Adjusted Odds Ratios[a] for the Categorical and Continuous Weight–by–Sex Interactions

	Major Depression, OR (95% CI)	Suicide Ideation, OR (95%CI)	Suicide Attempts, OR (95% CI)
Continuous weight (BMI)[b]			
Men	0.55 (0.48, 0.63)	0.74 (0.64, 0.86)	0.45 (0.40, 0.51)
Women	1.22 (1.06,1.40)	1.22 (1.13, 1.32)	1.22 (0.91, 1.63)
Categorical weight contrasts			
Underweight vs average weight			
Men	1.25 (1.18, 1.32)	1.81 (1.71, 1.89)	1.77 (1.34, 2.33)
Women	1.02 (0.84, 1.23)	1.10 (0.88, 1.34)	0.88 (0.55, 1.41)
Obese vs average weight			
Men	0.63 (0.60, 0.67)	1.02 (0.98, 1.06)	0.63 (0.48, 0.83)
Women	1.37 (1.09, 1.73)	1.20 (0.96, 1.50)	1.23 (0.74, 2.03)

Note. OR = odds ratio; 95% CI = 95% confidence interval.
[a]All ORs are adjusted for race, age, education, past-year income, self-reported disease history, and the race-by-weight interaction term.
[b]Odds ratios are presented for a 10-unit change in body mass index (BMI).

reluctance to disclose personal information to interviewers of a different race may have influenced the present results. Furthermore, a systematic inaccuracy in reported height and weight data (i.e., BMI) could have confounded the relationships demonstrated in this study. There is evidence that heavier individuals systematically underreport their weight relative to lighter individuals.[48] However, there is no evidence to suggest that the accuracy with which height and weight are reported systematically differs between those meeting and those not meeting criteria for *DSM-IV* major depressive disorder. For the present results to be spurious, such a systematic difference would need to be demonstrated. Moreover, the difference would have to be in opposite directions for males and females such that depressed females overreport their weight and depressed males underreport their weight. The present study cannot rule out this alternative explanation; however, there is no evidence for such a process to our knowledge.

Third, we did not have more precise measures of adiposity (e.g., from dual energy x-ray absorptiometry[49]) or adipose tissue distribution (e.g., indexes of visceral adiposity). Fourth, we did not have data on weight cycling, which may have relevance to psychopathology,[50] although a recent review found no significant association between weight cycling and significant psychopathology.[51] Fifth, the relationships between lower BMI and the psychiatric outcomes could have been due to an underlying illness. However, we think that this is not the case, for 2 reasons: the major depression diagnosis precludes depression related to known physical illness, and we statistically controlled for reported illness**.** It is also possible that some respondents had some unknown illness at the time of the survey or that self-reported illness is not very accurate. Thus, although our results cannot definitely rule out occult disease as a factor, it is unlikely to be the sole explanation.

A related question is whether BMI is a sufficient anthropometric index for modeling the relation between relative body weight and health outcomes.[52,53] For example, Michels et al.[52] found that neither BMI nor a simple linear combination of weight and height was sufficient to adequately model variation in systolic blood pressure in the Pediatric Task Force Database. Inclusion of additional covariates was recommended. It is unclear how alternative representations of relative body weight might have influenced the present results. On the other hand, BMI is an established index that has been used in most studies examining body weight and psychological variables.

In sum, our findings suggest that for women, obesity is associated not only with various medical complications but with psychiatric ones as well. In contrast, relative underweight was associated with increased psychopathology among men even after self-reported illness was controlled for. Given the increasing prevalence of obesity in our society and projections for this trend to continue, health care professionals can expect to treat an increasing number of obese patients in their practices. Our findings suggest that health care professionals should be attentive not only to traditional medical problems but also to major depression, suicide attempts, and suicide ideation among the heaviest women. Further longitudinal investigations of the development of depression and obesity, or their relationship over time, would be important, given that previous findings suggest that changes in affect precede changes in weight over time.[54,55] Indeed, as Neugebauer[56] recently

advocated, additional research linking physical and psychiatric disorders is needed in the public health field. □

Contributors

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